

# The Effects of Peer Information on Problem-Solving in a Connected Group

Thomas N. Wisdom  
Dept. of Psychological & Brain Sciences - Indiana University

Xianfeng Song  
Dept. of Physics - Indiana University

Robert L. Goldstone  
Dept. of Psychological & Brain Sciences - Indiana University

## Abstract

In this experiment, we implemented a problem-solving task in which groups of participants simultaneously play a simple puzzle game, with score feedback provided after each of 24 rounds. Each participant in a group is allowed to view and imitate the guesses of others during the game. Results show that when the utility of others' innovations is unambiguous, individuals base their own solutions on personal innovation and productively imitate other players' innovations early on, and that this tendency to imitate is proportional to the amount of information available from others. Results are consistent with previously studied social learning strategies in several taxa.

## Background

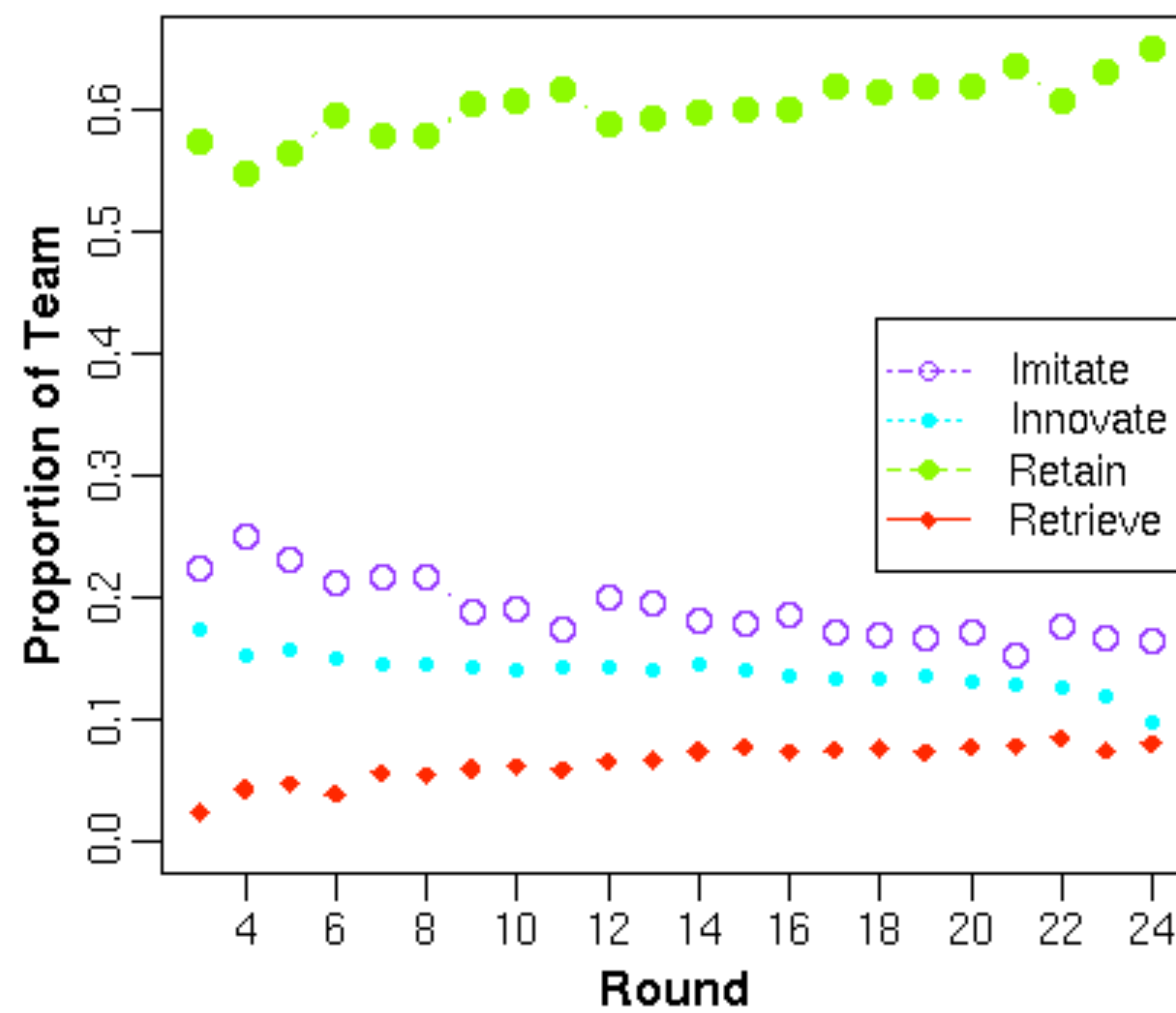
In uncertain situations, one can often obtain useful information from others that would be inaccurate or inefficient to procure on one's own. Boyd & Richerson (2005) define **social learning** as "the acquisition of behavior by observation or teaching from other conspecifics." But resources must generally be spent in gathering new information before it can be shared. Thus there is an apparent trade-off between individually producing new information (*innovation*) and social learning (*imitation*).


Boyd & Richerson (1985) showed that the tendency to imitate others rather than innovate ("conformity bias") can be adaptive in uncertain environments. They also showed that imitation can provide a net population fitness benefit by making individual learning more accurate or less costly -- e.g. by allowing selective learning or cumulative improvements (Boyd & Richerson 1995).

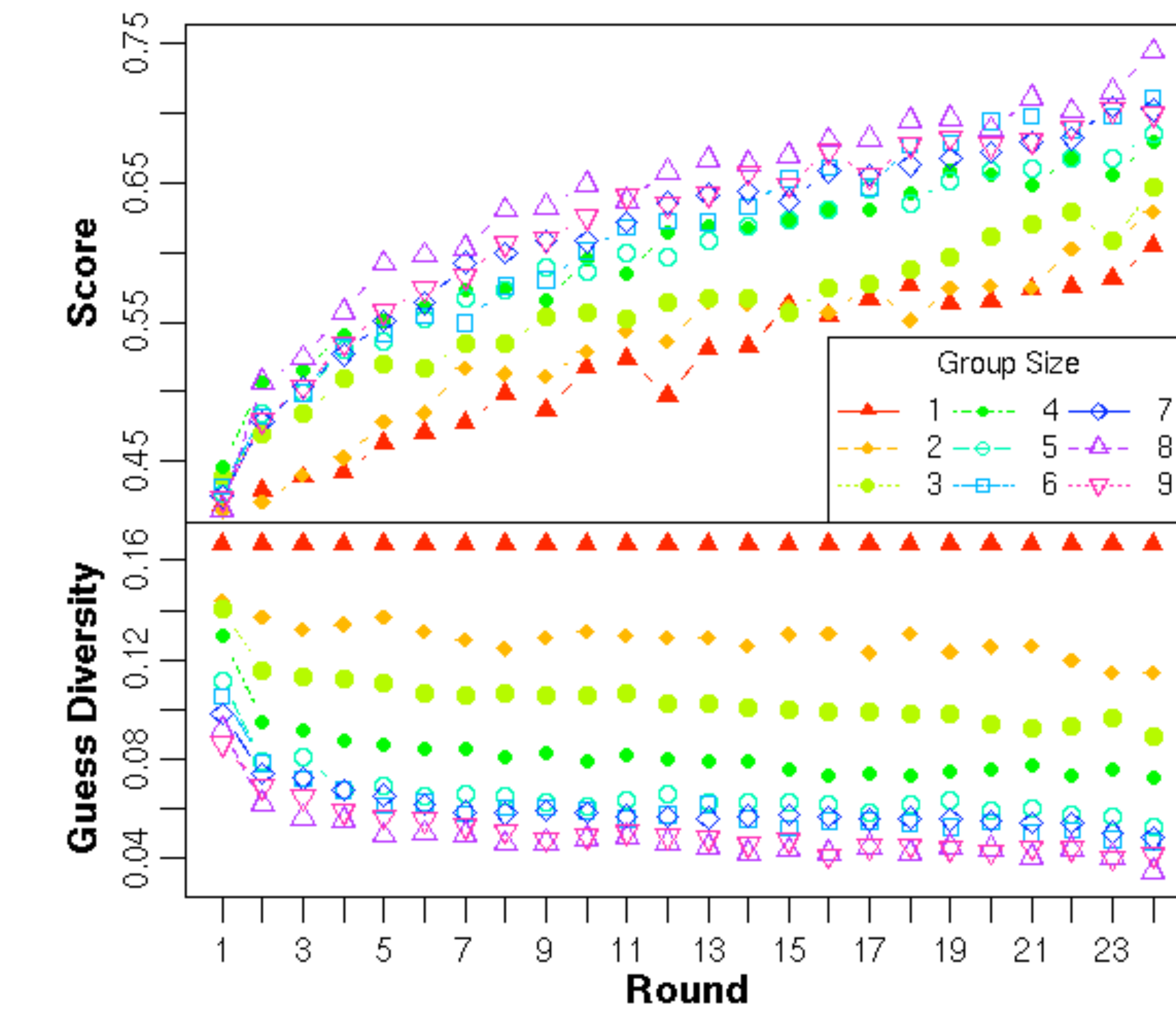
## Method

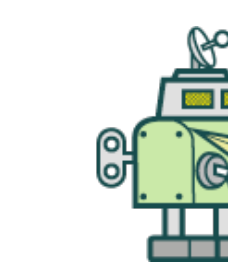
The experimental task is a game in which participants attempt to maximize the number of points earned by their chosen subsets ("teams") from a set ("league") of creature icons over 24 10-second rounds. Feedback is provided using a complex score function based on linear and interaction terms. Icons can be copied to a participant's current team by dragging and dropping them from a league area which shows all of the icons that can be chosen from (*innovation*), the teams of other participants in the group (*imitation*), or the participant's best-scoring team so far in the game (*retrieval*); icons may also be retained from one round to the next on one's own team (*retention*).

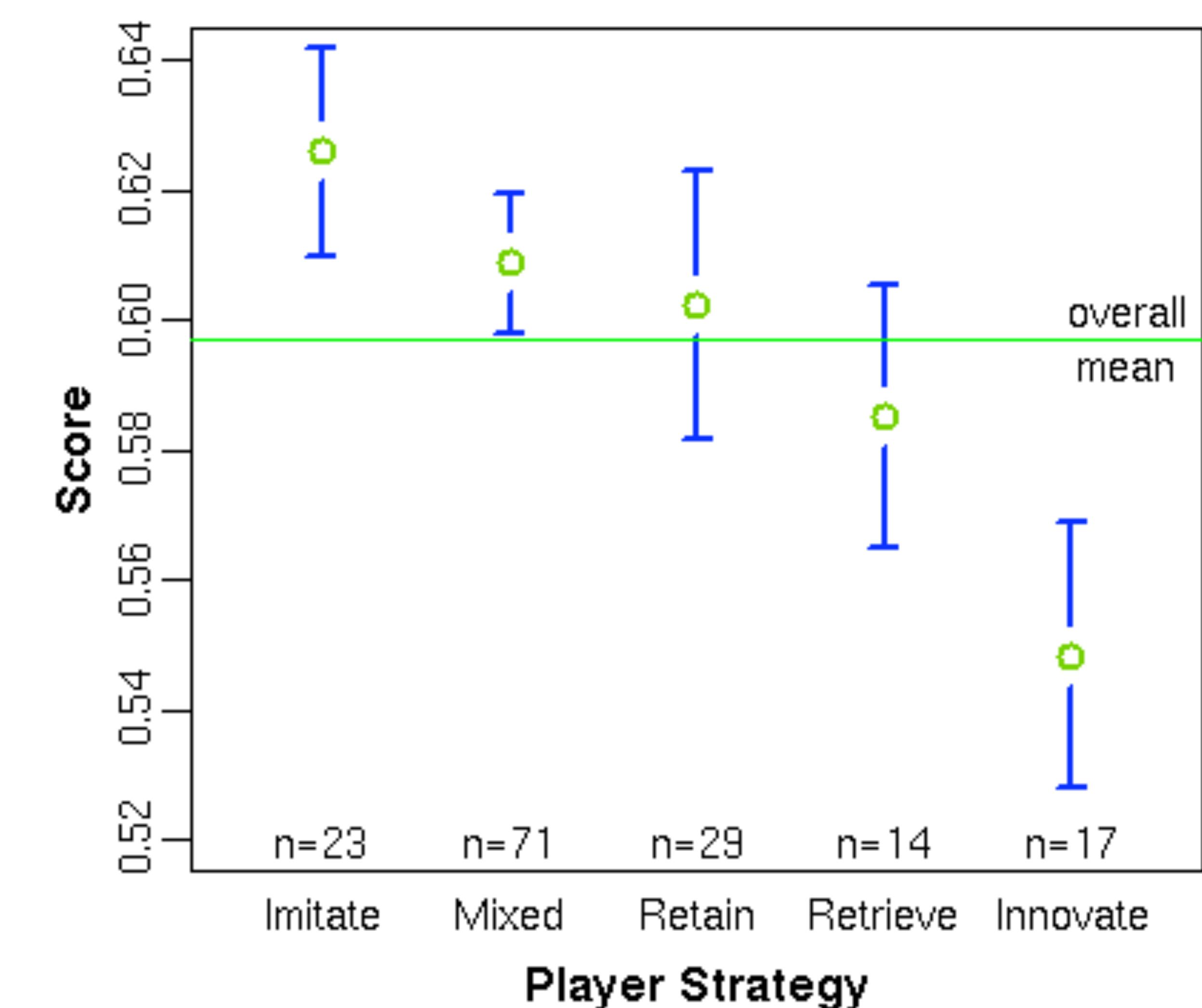
 **Result 1: Both imitation and innovation decrease over time as individual knowledge increases.**



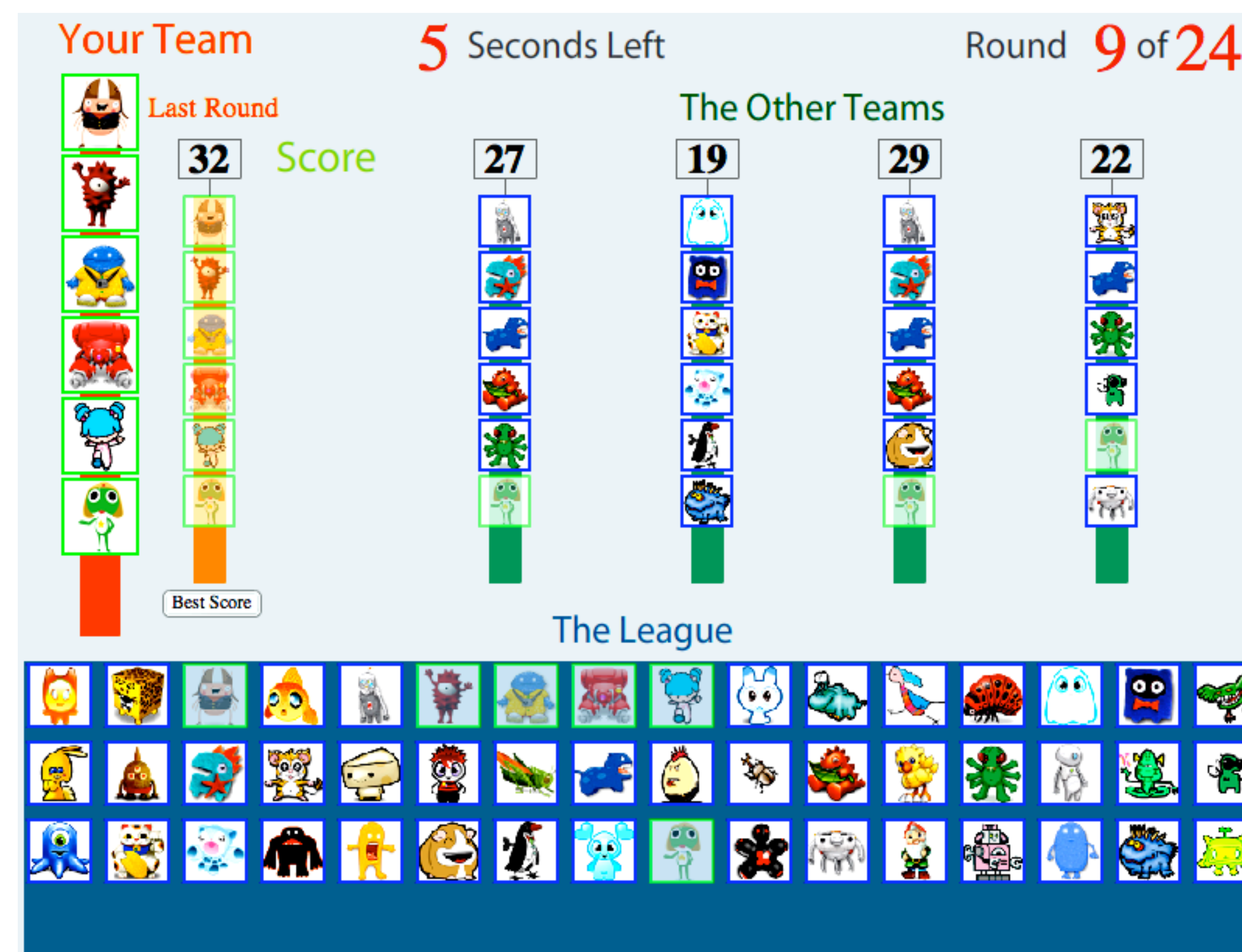
 **Result 2: People in larger groups settle faster on better (though not optimal) solutions, and imitate more.**



 **Result 3: An individual bias toward imitation (rather than innovation) produces greater returns.**



## Participant Interface



## Conclusions

1. Rather than imitate relentlessly or randomly, participants use imitation and innovation together to make individual cumulative improvements, employing the *uncertainty-reduction* capability of social learning (Kameda & Nakanishi, 2002).
2. Imitation increases when the payoff for innovation is relatively uncertain, compared to the abundant unambiguous information available about the content and utility of neighbors' guesses, consistent with Laland's (2004) *copy when uncertain* strategy.
  - Similar behavior has been observed in other taxa, including guppies choosing foraging sites and escape routes (Reader, Kendal & Laland 2003).
3. The high relative payoff for imitation is consistent with the "conformity bias" found by Boyd & Richerson (1985).

## Selected References

Boyd, R., & Richerson, P.J. (1985). *Culture and the evolutionary process*. Chicago: University of Chicago Press.  
 Boyd, R., & Richerson, P.J. (1995). Why Does Culture Increase Human Adaptability? *Ethology and Sociobiology*, 16, 125-143.  
 Boyd, R., & Richerson, P.J. (2005). *The origin and evolution of cultures*. New York: Oxford University Press.  
 Kameda, T., & Nakanishi, D. (2002). Cost-benefit analysis of social/cultural learning in a non-stationary uncertain environment: An evolutionary simulation and an experiment with human subjects. *Evolution and Human Behavior*, 23, 373-393.  
 Laland, K.N. (2004). Social learning strategies. *Learning & Behavior*, 32(1), 4-14.  
 Reader, S.M., Kendal, J.R., & Laland, K.N. (2003). Social learning of foraging sites and escape routes in wild Trinidadian guppies. *Animal Behaviour*, 66(4), 729-739.